



River Almanac

An Information Sharing Bulletin of the
Long Term Resource Monitoring Program

U.S. Department of the Interior
U.S. Geological Survey

Environmental Management Technical Center actively addressing Year 2000 problem

The year 2000 is forecast to present computer systems and users a plethora of problems. The Environmental Management Technical Center (EMTC) has developed a Year 2000 transition plan to ensure that operational effectiveness of the Center is not adversely affected by the turn of the century. The plan summarizes the problem, its magnitude, and the steps that must be taken in addressing the problem.

Most computer systems in use today record dates in a format using a two-digit number for the year; for example, 96 represents the year 1996. The two-digit year field is common among older systems, designed when memory storage was more expensive, but is also used in many systems built today. With this format, however, the year 2000 is indistinguishable from 1900. The year field in computer programs performs various functions, such as calculating age, sorting information by date, or comparing multiple dates. Thus, when years beyond 1999 are entered under this format, computer systems will fail to function properly. Given society's increasing reliance on computers, this problem could have a significant effect on a wide range of activities and interests worldwide, including commerce, government operations, military readiness, and the overall economy.

Computer systems of all sizes (mainframe, mini, and micro), as well as local area network and telecommunication systems must be assessed for

Continued on page 7



Ginny Stefanez, EMTC Computer Equipment Specialist, checking out a new computer to ensure Year 2000 compatibility. Ginny and other EMTC staff members are working to ensure that the year 2000 does not provide any surprises for the Environmental Management Technical Center. *EMTC Photo*

Massive ocean current may provide clues to global warming

National Science Foundation
Press Release

Scientists aboard the world's largest scientific drill ship, the JOIDES Resolution, will soon study a cold-water current that today is 100 times the size of the mighty Amazon River. The geologists will set sail from Sydney, Australia, August 16 on an expedition supported in part by the National Science Foundation (NSF), a major con-

Continued on page 10

In this issue

Articles

Addressing Year 2000	1
Global warming	1
Aerial photographs	6
Breeding ducks	7
River conference	10

Program Notes

Selected Abstracts

Personality Profile

Ken Lubinski	4
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New Reports

Selected abstracts of ongoing Long Term Resource Monitoring Program study efforts

Owens, T., and Y. Yin 1996. Effects of flooding on the Mississippi River floodplain. Paper presentation at the Rivertech '96 Conference, Chicago, Illinois, September 23, 1996.

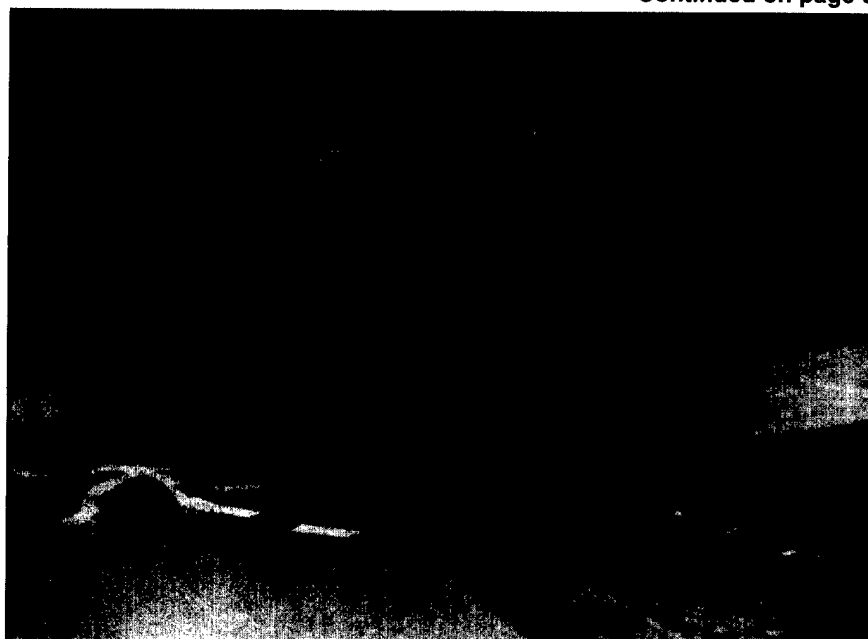
The 1993 flood on the Upper Mississippi River was a record setting event in terms of water elevation at many locations. The flood inundated the entire floodplain during the peak growing season during July and August of that year. This study compared the 1989 (pre-flood) and 1994 (post-flood) land cover/use data derived from aerial photointerpretation, along with forest surveys documenting the intermediate-term impacts of the 1993 flood on floodplain forests in Pool 26. Pool 26 is just above Saint Louis, Missouri, and the confluence of the Mississippi and Missouri Rivers occurs in this pool.

Sparks, R. E., A. Cangelosi, and J. E. Marsden. 1996. Chicago, Lake Michigan, and the Illinois River: Water quality successes and new stresses from inter-basin transfers and invasive species. Paper presented at the Rivertech '96 Conference, Chicago, Illinois, September 22-25, 1996.

There are two great ironies about the relationship between Chicago and its water resources: (1) the city is on the shore of one of the largest freshwater lakes in the world, but the water supply is limited, and (2) reduction of pollution led to another problem—inter-basin transfer of aquatic pests.

A U.S. Supreme Court decree limits the amount of water Chicago can divert from Lake Michigan to an annual average of $3,200 \text{ ft}^3 \text{ s}^{-1}$ ($90.6 \text{ m}^3 \text{ s}^{-1}$), in response to lawsuits from other Great Lakes states. The diverted water is not returned to the Great Lakes-St. Lawrence drainage, where it could be used to generate electric power in New York, Ontario, and Quebec, but instead is released into the

Continued on page 3



A student employee digitizing 1890s Mississippi River Commission land cover data for use by resource managers and decision makers. EMTC photo

River Almanac

River Almanac is an authorized publication of the U.S. Department of the Interior, published periodically by the Environmental Management Technical Center to provide an ongoing exchange of information between the EMTC and other Long Term Resource Monitoring Program participants and the general public.

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The Environmental Management Technical Center is a U.S. Geological Survey facility located in Onalaska, Wisconsin, USA. The Technical Center manages the Long Term Resource Monitoring Program (LTRMP), which is the largest river-related inventory and monitoring, research, spatial analysis, and information sharing program in the United States.

The Long Term Resource Monitoring Program for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information for maintaining the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character.

The LTRMP is a cooperative effort of the U.S. Geological Survey, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.

Questions or comments may be directed to the EMTC, River Almanac Staff, 575 Lester Avenue, Onalaska, WI 54650-8552, Telephone: 608/783-7550, Fax: 608/783-8058.

River Almanac is also available on the World Wide Web:

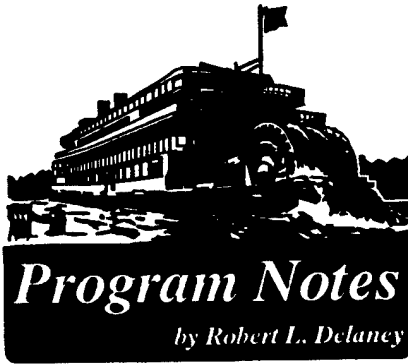
<http://www.emtc.usgs.gov>

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Abstracts from page 2

Mississippi drainage, through the Chicago Sanitary and Ship Canal and the Illinois River. The man-made canal cuts through the 12-ft-high natural divide that once separated the two drainages. As its name indicates, one purpose of the canal is to carry waste away from Chicago, thus maintaining a clean drinking water supply in Lake Michigan.

The gross pollution once discharged into the Chicago canal system damaged the Illinois River, but also protected the Mississippi and the Great Lakes ecosystems from each other's introduced aquatic pests. Since the U.S. Clean Water Act was enacted in 1972, 4 billion dollars have been spent on improved municipal waste treatment in the Chicago area, water quality has improved, and aquatic organisms can survive in the canal. Within the last 5 years, the European zebra mussel (*Dreissena polymorpha*) has spread from the Great Lakes into the Mississippi Drainage through the Chicago connection and at least six other nonnative pests are poised to enter. Conversely, the Asian grass carp (*Ctenopharyngodon idella*) and an African zooplankton (*Daphnia lumholzi*) are advancing upstream in the Illinois River and could soon enter Lake Michigan.

In the near future, the increasing environmental and economic costs associated with inter-basin transfers of pests, and the growth-limiting, finite water allocation currently in effect in the Chicago area, could lead to some innovations in managing regional water resources. Continuing improvement in wastewater treatment may soon make it possible to return wastewater to Lake Michigan, without impairing public beaches or the water supply. Chicago is the only city on the Great Lakes that transfers water out of the basin and whose water withdrawal is consequently limited. Alternatives might include: (1) complete separation (in effect, reestablishing the drainage

divide), or, more likely, (2) dispersal barriers that permit the passage of boats, but inhibit passage of organisms. All stormwater and wastewater in Chicago eventually will be treated, according to current plans, so this water should not contain invasive pests. What will remain untreated is water diverted directly from the lake into the canals for boat lockages, to maintain water depths for navigation, and to improve water quality by dilution. Improved waste treatment will reduce dilution requirements. Thermal effluents might be used in restricted areas to "pasteurize" the water, leaving no residual toxicity—a problem with chemical treatment. In the future, lock chambers might be filled from reservoirs of treated effluent, rather than directly from the lake itself, thereby preventing exchange of aquatic pests.

Wlosinski, J., and J. Rogala. 1996. Integrating hydraulic, statistical, and spatial models for predicting the effects of water level management alternatives. Paper presented at the Rivertech '96 Conference, Chicago, Illinois, September 22-25, 1996.

This report contains annotations from more than 800 papers and reports describing the effects of water levels on ecosystem components, primarily in fresh waters. An index containing key words is included to facilitate the location of references on certain subjects. Key words are also grouped into general categories. The work was performed as part of the Upper Mississippi River System Long Term Resource Monitoring Program.

Yin, Y., K. S. Lubinski, and C. E. Korschgen. 1996. Flooding disturbances and floodplain forest succession in the Upper Mississippi River. Paper presented at the Rivertech '96 Conference, Chicago, Illinois, September 22-25, 1996.

The Environmental Management Technical Center (Center) will soon "premier" its new outreach video *The Upper Mississippi River System-Long Term Resource Monitoring Program: Providing Sound Science for Better River Management*. The 13-minute video was created to increase awareness of the importance of the Upper Mississippi River System and to inform the public how Monitoring Program data are being used to improve management of vital river resources. The Center is strongly considering using a new technology—streaming video—that would allow Web users to view the video on their PCs in real time rather than having to wait hours for conventional multimedia files to download. The streaming video technology demonstrably reduces distribution costs while greatly expanding the potential audience.

The soon-to-be published *Ecological Status and Trends of the Upper Mississippi River System* report will be a landmark publication for the Center's Monitoring Program. The publication adopts a report card format to illustrate the condition of the river resources. This cooperative effort of over 60 contributors presents the analysis of 6 years worth of data on the Upper Mississippi River System. The report is but another tool for resource managers in making informed and sound river management decisions. □

Continued on page 7

Personality Profile

A closer look at the people who make the LTRMP a success

by Peter Klitzke

Ken Lubinski has spent much of his adult life studying the Upper Mississippi and Illinois Rivers. He has been with the Long Term Resource Monitoring Program (LTRMP) at the Environmental Management Technical Center (EMTC) for 11 years and is presently the (Acting) Director of Applied River Science. He has most recently overseen the development of the scientific content of the upcoming *Ecological Status and Trends of the Upper Mississippi River System* report: a summary of information gathered during the initial years of the LTRMP.



Ken Lubinski

Lubinski refers to the Mississippi as simply, "the River," in recognition of its dominance and influence. Another favored expression, "river stakeholders," he uses when referring to individuals, groups, or interests that use, make changes to, or are affected by the River. Agriculture, industry, shipping, recreation, refuge managers, conservationists, and government are all river stakeholders.

The River has an influence on him and Lubinski can become quite philosophical, but he is first a scientist. A danger to good science, he quickly points out, is losing objectivity. "It's that connection," he says, "the degree to which we are connected to the River as a natural resource—an emotional connection sometimes—that makes it hard to work science in an objective way. If we lose our objectivity, our ability to serve as unbiased advisors can be damaged permanently."

Lubinski earned a B.S. and an M.S. in Zoology from Western Illinois University, and a Ph.D. in Zoology from the Virginia Polytechnic Institute and State University. Before coming to EMTC, he worked as an Aquatic Biologist with the Illinois Natural History Survey and as Director of the Niota and Grafton Field Stations. He played a major role in setting up the field station network and organizing river science activities at the EMTC. Starting two years ago, and continuing in his present capacity, Lubinski began to link other research activities at the EMTC with the monitoring activities of the LTRMP to better meet the river management needs of the EMTC's partner organizations.

Lubinski is a well-published writer, the principle author of 11 of his 21 refereed publications. He organized the International Conference on Large River Ecology in La Crosse in 1984, at which scientists began the identification of specific criteria to assess river ecological integrity.

Besides writing technical papers, Lubinski has translated technical scientific information for the nonscientist river stakeholders. He wrote a series of four articles for a nonscientific audience on the role of science and scientists related

specifically to the Upper Mississippi River. He is frequently called upon to interpret research and monitoring findings in scientific and nonscientific forums. Subsequently, he often serves as liaison between the scientific community and other river stakeholders.

In the last two years, Lubinski has seen the LTRMP and the EMTC successfully pass three different major reviews. In 1996, a national review was conducted by an International Science Review Committee comprised of seven distinguished environmental scientists from universities, industry, and government. Next, a periodic management review was conducted by agency representatives from the states of Illinois, Iowa, and Missouri, and from the U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS). The latest, in 1997, was conducted by representatives from the USGS Biological Resources Division (BRD) who evaluated both the science and administration of the EMTC. "All of these reviews," he notes, "help to establish the scientific credibility and management relevance of the LTRMP."

Lubinski's experience, however, has not been limited to the task of compiling reliable and accurate scientific data. Among his in-service training is a diving certification—particularly diving under ice. Water clarity is best in the river when the watershed is locked in deep winter, so he became certified to dive under ice. He is one of just a few people who has personally seen and studied a section of the navigation channel floor.

John Madson, author of *Up on the River: An Upper Mississippi*

Chronicle, published in 1985 by Nick Lyons Books, describes the research of the channel floor in Pool 13 during the winter of 1984. Lubinski and a commercial diver and trainer, supported by a crew on the ice, dove using an umbilical cord air supply system and dry suit equipment through 15 inches of river ice in five different locations near Bellevue, Iowa. On the channel floor in one area they found piles of rocks inhabited by algae, insect larvae, and zooplankton, and in other areas only uninhabited bedrock. At other sites they observed mussel beds and wintering populations of fish. They found sand deposits packed in dunes and into hard ripples by the current. "The ice diving was a once-in-a-lifetime experience," Lubinski said. "It was typical of many of my field experiences in that it provided exciting new observations while achieving a practical goal, in this case guidance related to disposal of dredge material."

Madson, writing in the signature note of Lubinski's autographed copy of *Up on the River*, considers Lubinski to be "a sure-nuf river rat of the best kind." Lubinski quietly expressed his appreciation for being admitted into Madson's own elite corps of river-rats. "(Lubinski) has managed to overcome the handicap of his long exposure to campuses and has grown, well, *riverish*. Which is as much as you can expect of a good field man," wrote Madson.

[Lubinski's views of the social role of science are long reaching, permeating the role of the Long Term Resource Monitoring Program (LTRMP) applied river science. They are seen in the upcoming Ecological Status and Trends of the Upper Mississippi River System report (Status and Trends) that summarizes years of information and data collection activities.--ed] □

My job...

by Ken Lubinski, as told to Peter Klitzke

The role of a (river) scientist is not to set society's goals, but to objectively report the ecological condition of the river, and then (identify and describe) the consequences of society's actions. . . *Will those actions make the river better or worse?* . . . so that society can set its own goals and make decisions based on the best available information.

Status and Trends... The LTRMP data are intended to better equip all river stakeholders to make sound management decisions. The nearly 60 contributors (authors and others) who compiled and developed the Status and Trends document tried to maintain that focus. Effectively communicating the need and cost of maintaining the current ecological status of the UMRS to river stakeholders and policy makers must be sufficiently dramatic to spawn dialog, consensus, and action.

That is what our job (at the EMTC) is all about, helping society understand the costs and the consequences of its actions.

The report card format employed in the Status and Trends report is a work in progress. It interprets many numbers into a form understandable to river stakeholders. It is based upon six criteria; three criteria general to any ecosystem, and three specific to the UMRS. The criteria were derived from polling international leaders in river ecology and from a review of the related ecological literature regarding the characteristics of healthy large river ecosystems. The next phase after issuing the initial report card is to identify and monitor specific metrics that quantify each criteria. Numerous metrics for each criteria are required to achieve a clear understanding of the ecosystem and the effects of human dynamics.

The decision to use the report card format is controversial among some scientists inside and outside the LTRMP. There are a lot of scientists who consider this approach to be too "fuzzy." It is not something we can publish in a scientific journal and say "this is how we repeated our experiments" or "here are our confidence levels."

The River... Things go slowly on the River (in regards to the speed of decision making and resulting actions). The River demands patience and persistence. On the other hand you always have the mind set that you are working on something tremendously important.

Every once in a while the River gives you an opportunity to be philosophical or even poetic; perhaps more than on other systems. I remember a couple of years ago when the Upper Mississippi River Conservation Committee, who have met now for 50 years — biologists — scientists — got together to celebrate their 50th anniversary. Members were asked to submit one-liners about what the river meant to them. There were some really good ones. I submitted three. "The River is my confessional," "The River is my link to greatness," and "The river is my Prozac." They're all still true. Hey! T. S. Elliott and Mark Twain can rest easy for lack of any competition from me. But I enjoy knowing that there is no greater natural resource on which to work. □

Providing on-line access to oblique aerial photographs of the Mississippi and Illinois Rivers and their floodplains

by Mary R. Craig

The EMTC collection of oblique photographs of the Mississippi and Illinois Rivers is a rich and valuable resource for river scientists and managers.

In 1997, a team from the Environmental Management Technical Center (EMTC), in cooperation with the U.S. Fish and Wildlife Service, flew and photographed the Mississippi and Illinois Rivers and their floodplains. Approximately 2000 oblique aerial photographs, in slide format, were taken as part of ongoing research to evaluate changes in floodplain structure along the navigable length of the Mississippi River (Minneapolis, Minnesota, to the Gulf of Mexico). Nearly 300 photographs were taken along the Illinois River between Chillicothe and Grafton, Illinois. The photographs capture aspects of the rivers' landscapes (Figure 1) and document river-management activities such as channel maintenance practices and habitat rehabilitation and enhancement projects.

The EMTC collection of oblique aerial photographs is of great interest to river managers and scientists; to date, the Center has received requests for more than 600 duplicate slides. Requests have come from a variety of sources including federal and state agencies; universities; and a private,

The EMTC collection of oblique aerial photographs is of great interest to river scientists and managers

natural resources group seeking to establish a sanctuary. The EMTC, because of the widespread interest and perceived value of this collection of photographs, has received funding



The Black River delta looking upstream from about river mile 708. The main channel of the Mississippi River is in the upper left and the u-shaped Pigeon Island is at top center.

Photo by Mary R. Craig

assistance from the USGS National Biological Information Infrastructure to make the collection available through the World Wide Web.

To provide on-line access, the slides are being electronically scanned and their locations geo-referenced; high-resolution images of the photographs will be served from the EMTC web site (<http://www.emtc.usgs.gov>). The web site will be updated and modified to include the oblique aerial photographs with the color-infrared aerial photographs now available. The first oblique aerial photographs will be those of the reach of the Upper Mississippi River extending from Cairo, Illinois, to St. Louis, Missouri. The target date to have this set of photographs available from the web site is February 1999. The entire collection of oblique aerial photographs should be accessible by November 1999.

The EMTC collection of oblique photographs of the Mississippi and Illinois Rivers is a rich and valuable resource for river managers and scientists. These aerial photographs have direct application for assessing habitat needs, planning habitat rehabilitation and enhancement projects, developing decision support system applications, executing adaptive ecosystem assessments, and planning of emergency response to potential hazardous and toxic spills. This unique collection of photographs continues to be useful for research and support of ongoing resource management and planning activities on the Mississippi and Illinois Rivers.

For further information, contact: Mary R. Craig, U.S. Geological Survey, Environmental Management Technical Center, 575 Lester Avenue, Onalaska, Wisconsin 54650. Phone: 608/783-7550, ext. 710, E-mail: Mary_R_Craig@usgs.gov □

Abstracts from page 3

In summer 1994, following 1993's unusually large flood in the Upper Mississippi River (UMR), we surveyed seven representative reaches to document flood-induced mortality of floodplain trees. We surveyed the same seven reaches again in summer 1995 to continue documenting flood-induced tree mortality and to investigate the seedlings of floodplain hardwood species recruited after the flood disturbance. The seven reaches include Navigation Pools 4, 8, 13, 17, 22, and 26, and a 80.5-km stretch of open river 48.3 km above the confluence with the Ohio River. By summer 1994, trees 10 cm or greater in diameter that had died since the flood constituted the following percentages of tree populations: 1.1% at Pool 4, 1.7% at Pool 8, 3.8% at Pool 13, 18.1% at Pool 17, 20.1% at Pool 22, 37.2% at Pool 26, and 32.7% at the open river reach. Saplings (trees between 2.5 and 9.9 cm in diameter) that had died since the flood constituted the following percentages of sapling populations: 1.8% at Pool 4, 7.2% at Pool 8, 9.2% at Pool 13, 47.8% at Pool 17, 72% at Pool 22, 80.1% at Pool 26, and 77.2% at the open river reach. Between the summers of 1994 and 1995, mortality was at approximately the same level as that of a non-flooding year.

Using data gathered in the two surveys, we simulated the succession of the floodplain forests with a "Markov-chain" model based on interspecific replacement probability matrices, also referred to as transition matrices. With the model, we projected the directions of succession under three flood scenarios. Under scenario A, succession proceeded without recurrent floods of the magnitude of the 1993 flood, and the transition matrix was determined based on the tree to sapling relationships before the 1993 flood. Under scenario B, succession proceeded with recurrent floods, and the transition matrix was determined based on the tree to sapling relationships after the

1993 flood. Under scenario C, succession proceeded with recurrent floods, and the transition matrix was determined based on the tree to seedling relationships after the 1993 flood.

Before the 1993 flood, succession proceeded toward a forest structure with less *Acer saccharinum* in Pools 4, 8, 13, 17, and 26; and toward a forest structure with more *Acer saccharinum* in Pool 22 and the open river. *Acer saccharinum* has been the top dominant species throughout the UMR for at least two decades. In Pools 4, 8, and 13, where the flood caused minor mortality of saplings, the directions of succession

Continued on page 8

Population of breeding ducks lower

The population of breeding ducks has made a downward turn from 3 years of record-high numbers. According to the U.S. Fish and Wildlife Service annual breeding duck survey of key nesting areas, the population has dropped 8 percent to 39.1 million.

"For the last 3 years, we have enjoyed favorable weather and habitat conditions in the continent's northern duck factory' that, combined with the millions of acres of wetlands restored in the past decade, have boosted duck populations," Service Director Jamie Rappaport Clark said. "This year's breeding duck survey reminds us that dry cycles can return. Dry years, and the low duck numbers that go with them, remind us forcefully of the need for continued habitat conservation."

The traditional breeding duck survey samples 1.3 million square miles across the north-central United States, western and northern Canada, and Alaska. Analysis of the survey reveals the approximate number of ducks in important breeding areas. □

Year 2000 from page 1

this problem and converted to a four-digit year field where necessary. Year data fields must be corrected in operating systems, compilers, applications, procedures, and databases. Unfortunately, it is often impossible to determine whether and how a computer system needs to be modified without reviewing all of its software code. While correcting the problem for stand-alone PCs may not be difficult, experts agree that all computer systems must be inspected, corrected, and tested before January 1, 2000, to avoid major system malfunctions.

At the EMTC, problems might surface in a variety of electronic equipment. Most obvious are our microcomputers, laboratory analytical equipment, network and application file servers, and network routers. Also subject to error are the telephone system, the building security system, and our commercial and custom developed software products.

Staff at the EMTC are taking specific actions to ensure a smooth Year 2000 transition at the Center. "We are looking at our microcomputers, data servers, laboratory equipment, installed software, and our local area network," explained Automation Support Manager, Linda Leake. "We are confident that there will be no surprises of consequence on January 1, 2000." □

New Reports

from page 16

Tucker, J. K., C. H. Theiling, F. J. Janzen, and G. L. Paukstis. 1997. **Sensitivity to aerial exposure: Potential of system-wide drawdowns to manage zebra mussels in the Mississippi River.** Regulated Rivers: Research & Management 13:479-487. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, May 1998. LTRMP 98-R009. 9pp. □

Abstracts from page 7

remained unchanged regardless of whether scenarios A, B, or C were chosen. In the other four reaches, where the flood caused major mortality of saplings, the trends of succession were interrupted. In each of the four reaches, the direction of succession set forth by newly recruited seedlings (scenario C) is toward a forest structure that will be similar to the current forest structure.

Our study provides an example of floodplain forest dynamics. Recurrent major flooding disturbances, like the disturbance below Pool 13 of the UMR caused by the 1993 flood, interrupt the autogenic succession that leads toward communities less adapted to flooding and rejuvenate the allogenic succession that perpetuates communities well adapted to flooding.

Burdis, R. M., and W. A. Popp. 1997. Winter primary productivity in Lake Pepin. Poster presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

Lake Pepin, a natural impoundment of the Mississippi River, has received considerable attention in the past few years due to severe nuisance algal blooms and fish kills that occurred during low flow in 1988. Emphasis has been placed on the origin, both internal and external, of phosphorus in Lake Pepin and the potential effects on water quality if loading is reduced. Most of the work has focused on summer water quality conditions because this is the period of high recreational use and potential nuisance algal blooms. Data collected by the Minnesota Department of Natural Resources as part of the Federal Long Term Resource Monitoring Program indicate high winter primary productivity in Lake Pepin in years with low discharge and minimal snow cover. This poster examines winter primary productivity and phosphorus loading in Lake Pepin from 1991 to 1996.

Craig, M. R. 1997. The fragmentation of terrestrial habitats along the Upper Mississippi River corridor. Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

Major landscape transformations related to row crop cultivation, deforestation, navigation, and urbanization may all directly contribute to the fragmentation of terrestrial habitats within riverine landscapes. I present the results of my analyses of the fragmentation of terrestrial habitat types (forests, "grasses/forbs", and "sand/mud") within six landscapes along the Upper Mississippi River corridor. Traditional models of habitat fragmentation include processes such as habitat loss, increases in patch density, diminution in patch size, and increases in interpatch distance. The results of my analyses, however, do not entirely conform to traditional models. Habitat loss over the past 100 years has indeed been extensive. Losses of forested habitat range from

Local staff brief congressional coalition in U.S. Capitol



Briefing team (l to r) Norman Hildrum, Olivia Ferriter, Carl Korschgen, and Lara Hill.

Local staff members, Norman Hildrum and Carl Korschgen, joined Lara Hill, U.S. Fish and Wildlife Service, La Crosse, and Olivia Ferriter, BRD Congressional Coordinator, in briefing members of Congress and Congressional staff members in Washington, D.C. The briefing was to a Congressional coalition headed, in part, by Congressman Ron Kind. The briefing provided information on the Decision Support System developed and put in use in conjunction with work on the Upper Mississippi River System. □

19.11 to 64.37 percent; losses of "grasses/forbs" habitat range from 26.76 to 47.09 percent; losses of "sand/mud" habitat range from 62.7 to 96.37 percent. Although the density of forested patches and "grasses/forbs" patches has increased in each landscape, the density of "sand/mud" patches has decreased dramatically. The average size of forest patches has decreased in each landscape; the average interpatch distance (edge to edge) has, however, decreased. Although the average size of "grasses/forbs" patches has decreased in four landscapes, the average interpatch distance has decreased in each landscape. The average size of "sand/mud" patches has not changed appreciably in five landscapes, and changes in interpatch distance vary among all landscapes. My analysis of patch dispersion shows that shortly before the turn of the century patches of forest and of "grasses/forbs" were randomly distributed within each landscape; today, however, they exhibit an aggregated distribution. Patches of "sand/mud" once exhibited and still maintain an aggregated distribution. Within riverine landscapes, the effects of the fragmentation of terrestrial habitat types may be offset by the aggregation of terrestrial habitat patches which confers a degree of habitat connectivity that has not been observed in other landscapes.

Dukerschein, J. T. 1997. Changes in wild rice (*Zizania Aquatica* L.) Coverages in Pool 8, Upper

Mississippi River, 1989–1995.
Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

In Wisconsin and Minnesota, wild rice stands are valuable, protected wetlands because they provide food and cover for wildlife such as waterbirds and muskrats and highly nutritious grain for humans. Although wild rice has been harvested by native Americans for centuries, on federal refuges such as the Upper Mississippi Fish and Wildlife Refuge in Pool 8 no harvesting by humans is permitted. In 1989 and 1991–1996, the WDNR/LTRMP monitored wild rice along with other submersed, floating-leaved and emergent aquatic plants in Pool 8, UMRS, through interpreted 1:15,000 color-infrared aerial photography along with ground-truthing. No wild rice (*Zizania aquatica* L.) was detected in Pool 8 by WDNR/LTRMP staff in the field or on aerial photos in 1989, a year of drought, or 1993, the year of the great flood. A 0.16-hectare (0.4-acre) patch of wild rice was delineated in the Blue Lake/Target Lake backwater of Pool 8 in 1991, and a fringe too small to delineate on the photo was detected in the field in 1992. Coverage of wild rice increased to 148 hectares (365 acres) of pure or mixed stands of wild rice in Pool 8 in 1994, and a mean density of 9.6 wild rice stems/m² was calculated along three 50-m transects containing wild rice in the Blue Lake/Target Lake area. Also in 1994, mature wild rice was observed in the field and delineated on the photos in Lawrence Lake. Wild rice continued to appear in Blue Lake, Target Lake, and Lawrence Lake in 1995 and 1996, totaling 233 hectares (577 acres) of pure or mixed stands in 1995, and preliminary data indicate about 215 hectares (531 acres) of pure or mixed stands in 1996. However, if only pure stands >90% wild rice cover are considered (polygons with a classification of 724D under the current LTRMP classification), areas de-

creased from 124.5 hectares (n=23 polygons) in 1994 to 5.9 hectares (n=4 polygons) in 1995 and there were 10 polygons in 1996 (exact areas were not available). Selected water quality data and main channel river stage data are presented along with wild rice data.

Gaugush, R. F. 1997. Suspended sediment budgets for Pool 13 and La Grange Pool of the Upper Mississippi River System: results for the 1995 water year. Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

The transport of sediment into and out of the navigation pools of the UMRS must be quantified as a first step in predicting the long-term configuration of the system. To address this issue, a cooperative effort by the Environmental Management Technical Center, the United States Geological Survey/Water Resources Division, and the States of Illinois and Iowa was initiated in 1994 to develop pool-scale budgets for Pool 13 on the Mississippi River and the La Grange Pool on the Illinois River. Work conducted in 1994 primarily consisted of site reconnaissance and upgrading gaging stations from discharge only to discharge and suspended sediment stations. Work was also conducted to place additional gaging stations on the Mississippi River. Actual sampling (suspended sediment) and recording gage measurements began in October 1994 (the beginning of the 1995 water year). This sampling effort will continue through the end of water year 1997. Pool 13 stretches from river mile 522.5 at L/D 13 to river mile 556.7 at L/D 12. Drainage area for Pool 13 at L/D 13 is 221,400 km², of which 96 percent (213,400 km²) is contributed by the Mississippi River at L/D 12. The remaining 4 percent, approximately 8,000 km², is contributed by smaller tributaries feeding directly into Pool 13. The largest of these are the

Maquoketa and the Elks Rivers entering from the Iowa side and the Apple and Plum Rivers entering from the Illinois side. The work associated with Pool 13 involves monitoring two sites on the Mississippi River (at Lock and Dam 12 (above Pool 13) and at Clinton, Iowa (below Pool 13)) and the above four tributaries to Pool 13 for discharge and suspended sediment concentrations. The La Grange Pool extends from river mile 80.2 at the La Grange L/D to river mile 157.7 at the Peoria L/D with a total length of 48.2 km (77.5 mi). Drainage area for the La Grange Pool at the La Grange L/D is 66,400 km², of which 57 percent (37,700 km²) is contributed by the Illinois River at the Peoria L/D. The remaining 46 percent, approximately 28,700 km², is contributed by a number of smaller tributaries feeding directly into the La Grange Pool. Four major tributaries, the Sangamon, Mackinaw, Spoon, and La Moine Rivers, account for 88 percent of the 28,700 km² that drain directly into the La Grange Pool. In La Grange Pool, monitoring involves two sites on the Illinois River (at Pekin, Illinois (above the La Grange Pool) and at Valley City, Illinois (below the La Grange Pool)) and the above four tributaries to the pool. The Mississippi River at Lock and Dam 12 accounts for 97 % and 83 % of the annual water and sediment load, respectively, to Pool 13. The four tributaries provide the remaining 3 % of the water inflow and 17 % of the sediment load. It is quite evident that the water and sediment mass balance for Pool 13 is dominated by the Mississippi River. This is not unexpected when the Mississippi River accounts for 96 % of the pool's drainage area. The situation is quite different for the La Grange Pool where the drainage area represented by the Illinois River is almost equal to that of the tributaries. The Illinois River above the pool accounts for 65 % of the water inflow and only 23 % of the sediment load to the pool. The four tributaries provide 35 % of the water inflow and 77 % of the sediment load. The average

Continued on page 10

Abstracts from page 9

sediment export rate to Pool 13 is 13,000 kg/km² whereas the rate per unit area to the La Grange Pool is over 5 times greater at 67,500 kg/km².

Gowda, P. H., T. Owens, J. G. Lyon, and Y. Yin. 1997. Evaluation of hydice sensor for mapping floodplain vegetation in the Upper Mississippi River System. Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24-25, 1997.

Efficient inventory of natural systems such as forest, wetland, and floodplain ecosystems is required for monitoring resources. Remote sensing technologies allow monitoring at various levels of detail. Several multispectral sensors such as Landsat Multispectral Scanner (MSS) and Thematic Mapper (TM) are being used for this purpose, however, they lack narrow bandwidths and higher spatial resolution required for more precise mapping. The Hyperspectral Digital Imagery Collection Experiment (HYDICE) sensor is a second generation, "state-of-the-art," nadir-viewing, push broom, high resolution airborne imaging spectroradiometer. This sensor system was developed by the Hughes Danbury Optical Systems in coordination with the Naval Research Laboratory and funded by the U.S. Government. The sensor was intended for various purposes such as evaluations of vegetation, water quality, bathymetry, and minerals. The spatial resolution varies from 1 to 4 meters depending on the aircraft's altitude above ground level, and the spectral resolution includes 210 contiguous bandwidths from the visible to shortwave infrared (400-2500 nm). An evaluation of the HYDICE sensor was made for identifying floodplain vegetation in the Upper Mississippi River System. For this purpose, a 16-bit hyperspectral image at 4-meter spatial resolution was acquired for Potter's marsh area of Pool

Conference announced combining Humanities and Upper Mississippi River

The University of St. Thomas Environmental Studies Program, in collaboration with a number of public educational institutions and resource management agencies, is sponsoring a conference examining the Upper Mississippi River through history, literature, art history, and other humanities disciplines. The conference, "River of Dreams: the Humanities and the Upper Mississippi River," will be held in St. Paul, Minnesota, September 24-26, 1998.

Invited humanities scholars will deliver papers in a series of plenary sessions, and will be joined at the podium by river resource managers and

planners. The resulting conversations will, we expect, be both interdisciplinary and multi-professional, as wildlife biologists debate with artists, and humanities scholars compare views with river managers. Panel discussions and other activities will ensure opportunities for participation by all conference attendees.

For more information about the conference, and to be put on the registration mailing list, contact Patrick Nunnally at 612-962-5692 or via e-mail at pdnunnally@stthomas.edu. More information is available at the conference web site, www.scs.stthomas.edu/environment/default.htm. □

Ocean current from page 1

tributor to the international Ocean Drilling Program (ODP), under the aegis of which the research will take place.

"Racing at remote southwest Pacific Ocean depths, the Deep Western Boundary Current (DWBC) forms part of a global system of ocean circulation that distributes heat around the planet, and may play a key role in controlling climate change," explains Bruce Malfait, ODP director at NSF. "This current channels 40 percent of the world's newly formed, cold deep water throughout the oceans."

The current's role in controlling climatic changes will be studied by a team of 26 scientists representing nine countries. Geologists Bob Carter of James Cook University (Australia) and Nick McCave of Cambridge University (UK) will head the scientific team that will reconstruct the history of the world's largest deep ocean current.

The scientists will seek answers to questions about climate change by analyzing samples of deep-sea mud, which is shaped by the deep currents to form great mounds on the sea floor. Core samples will be collected from deep within these mounds. □

13 in the Upper Mississippi River System. Required ground truth data was collected for understanding the spectral behavior of floodplain features and for preparing the land cover map. A preliminary spectral analysis was made for those features by comparing their brightness values for the 210 spectral bands. A set of suitable bands was selected based on individual bands' ability to discriminate floodplain features. Land cover maps were developed for the Potter's marsh area

using unsupervised and supervised classification techniques. Evaluation of the land cover maps indicated that high quality floodplain vegetation maps can be developed from hyperspectral images acquired using the HYDICE sensor.

Johnson, B., R. Gaugush, and S. Light. 1997. Adaptive environmental assessment applied to the Upper Mississippi River: A demonstration of models.

Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

Adaptive environmental assessment (AEA) is a process that draws on the experience and knowledge of multiple stakeholders to develop a common understanding of a specific resource management problem. This common understanding is translated into computer models that can be used to probe both the extent of that understanding and potential solutions to the problem. An AEA process was begun for the Upper Mississippi River with a scoping workshop in December 1995, where 50 participants identified key resource issues and system boundaries, defined critical processes and relationships, and described potential policy actions and response indicators. A modeling team then constructed two computer models that were evaluated during a second workshop in January 1997. Both models are based on the fundamental river processes of water and sediment movement, but operate at different spatial scales: one is a river system model, the other is a single-pool model. The river system model tracks the flow of water and sediment among pools and can be used to simulate alternative stage height policies for one or more pools, taking into account natural variation in flows and the operating constraints of the lock and dam system. A navigation/economic component translates the effects of stage policies, which influence channel depth and sediment deposition, into changes in dredging needs and shipping potential. This 1-dimensional model is currently programmed for pools 2 through 10, and can display graphical or tabular results for sediments, discharge, stage, and shipping activity. The 2-dimensional pool model has been developed with Pool 8 as the test case. The model tracks water elevation and depth, flow direction, wind energy, and sediment deposition and resuspension, as well as vegetation response, on a monthly time step over a

1-hectare grid. Responses of each variable are viewed with on-screen maps. Alternative stage management policies can be simulated to assess their effects on aquatic and terrestrial habitats. Topography within a pool can be changed to investigate the effect of water depth, training structures, islands, or levees on model variables. Both models will be demonstrated and available for examination during the poster session.

Mihuc, T. B. 1997. Macroinvertebrate communities in littoral regions of a large river-floodplain: relationships with water quality and vegetation. Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

Distribution and habitat requirements of aquatic macroinvertebrates among native and exotic macrophytes in the Atchafalaya River Basin, Louisiana were examined in 1994-1995. The Atchafalaya is the major tributary in the lower Mississippi River delta, representing the largest contiguous hardwood swamp and the sixth largest river in the U.S. The Atchafalaya Basin contains one of the few intact large river-floodplain systems remaining in the U.S., retaining at least half of its original floodplain. Sampling involved vertical littoral net hauls taken at 49 sites encompassing 9 vegetation types and 2 water quality types (blackwater, brownwater). Differences in habitat use among taxa were compared using multivariate analyses. Differences in community structure were apparent between vegetation types but less evident between water quality types. Exotic water hyacinth (*Eichhornia crassipes*) and *Hydrilla verticillata* showed an altered macroinvertebrate community structure versus most native macrophyte habitat (*Ceratophyllum demersum*, *Nelumbo lutea*, *Cabomba*, *Vallisneria americana*, and *Najas*). Native *Sagittaria*, however, harbored a similar animal community as water hyacinth. Differences were also found

between the two exotic types. In summary, native macrophytes contained similar invertebrate communities that were dissimilar from both exotic macrophytes. Furthermore, the two exotic macrophytes differed from one another in community structure. The impact of exotic macrophyte introductions and the ongoing *Dreissena* invasion on aquatic animal communities in the Atchafalaya River Basin appears to be severe, resulting in restructuring of macroinvertebrate communities from the indigenous state.

Wlosinski, J. H., and S. R. Marecek. 1997. Changes in winter water levels on the Upper Mississippi River. Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24–25, 1997.

Water regulations for dams in the St. Paul and Rock Island Districts of the U.S. Army Corps of Engineers allow lower winter water levels, by approximately 0.5 ft, than levels maintained during the navigation season. The two Districts agreed to hold water levels on the high side of the operating band during the winter of 1995-1996 at the request of natural resource agencies. The request was based on the need to improve backwater habitats for overwintering fish. We analyzed water levels for Pools 2 through 22 for the first 60 days of each year from 1991 through 1996. In addition, we analyzed dissolved oxygen, temperature, and water velocities as a function of water depth, and dissolved oxygen as a function of snow depth and percentage of snow coverage. Data for the additional variables was collected for the same time periods by the Long Term Resource Monitoring Program field stations in Pools 4, 8, 13, and 26. Water levels during the winter of 1995-1996 were significantly higher ($p = .05$) for 17 of 22 dams when compared to other years, ranging from 0.07 ft to 0.83 ft higher. Water levels in pools showing non-significance ranged from 0.06 ft lower to 0.22 ft higher. Part of

the difference in increased water levels during the winter of 1995-1996 may be attributed to higher discharges for pools managed with two control points. Dissolved oxygen, temperature, and water velocities as a function of depth were analyzed across all four pools at both stratified random and fixed sites. Sample sizes ranged from 94 to 335. Only dissolved oxygen from the stratified random samples showed positive significance, and only weakly so. R^2 values were less than 0.2 for all stratified random and fixed sites. Dissolved oxygen as a function of snow depth and percentage of snow coverage was significant for both stratified random and fixed sites, but again only weakly so.

Yin, Y. 1997. How to estimate inundation-induced tree mortality using river water level data. Paper presented at the Twenty-Ninth Annual Meeting of the Mississippi River Research Consortium, La Crosse, Wisconsin, April 24-25, 1997.

I have developed a method for estimating the probability of tree mortality due to inundation using river water level data. The probability is defined as a function of inundation duration and size of the tree. The method includes a formula to determine the threshold water level of inundation using historical river water level data, and formulas to estimate the probability of tree mortality based on inundation duration and tree size. Inundation duration is defined as the total number of days when river water level is at or above the threshold water level between January 1 and December 31. Parameters in the tree mortality probability formulas were estimated by applying linear logistic regression on data collected in 1994 and 1995 at seven reaches along the Upper Mississippi River. The formulas were tested against data collected in 1994 and 1995 at one reach on the Illinois River. Test results indicate that these formulas have potentials for applications in other river reaches. Formulas are now

available for *Acer saccharinum*, *Fraxinus pennsylvanica*, *Ulmus americana*, *Populus deltoides*, *Acer negundo*, *Celtis occidentalis*, *Morus rubra*, *Salix nigra*, and *Betula nigra*.

Nelson, J. C., and R. E. Sparks. 1997. Fire and flood: Role of disturbance in structuring presettlement floodplain vegetation and as a tool in restoration. Paper presented at the Seventh International Symposium on Regulated Streams, Chattanooga, Tennessee, August 25-29, 1997.

Historical data are critical for evaluating the biological integrity of large river-floodplain ecosystems, especially those altered by humans. Presettlement baseline datasets are especially useful because they can be used to measure change and to identify target restoration conditions. Furthermore, presettlement data can provide valuable information about natural processes that sustain biodiversity. In this study, we used General Land Office (GLO) survey records to reconstruct vegetation patterns that existed 150 years ago along upper Mississippi River Reaches 4 and 8. The term "reach" pertains to a section of river between two navigation dams. Reaches on the upper Mississippi range between 8 and 80 km in length and are numbered consecutively starting upstream with Reach 1 near Minneapolis, Minnesota, and culminating downstream with Reach 26 near St. Louis, Missouri. In 1850, The GLO surveyors described much of the upland vegetation along both sides of River Reaches 4 and 8 as "oak openings" or as "scattered timber." These descriptions suggest that savanna communities covered much of the region prior to Euro-American settlement. The dominant trees were white oak, bur oak, and black oak. Very low tree density estimates (~13 trees/ha), obtained from bearing tree distances, provide additional evidence that savannas were widespread. Surveyors also encountered prairies in the uplands and according to plat maps these prairies

varied greatly in shape and size. Some mesic forest communities containing basswood, sugar maple, and elm also occurred in the uplands, but according to the importance values of these indicator species, mesic forests were much less extensive than open savannas. On the floodplains, the GLO surveyors recorded a different mix of tree species. Dominant taxa included bur oak, silver maple, ash, elm, birch, black oak, and willow. Surprisingly, despite a different complement of tree species in a presumably moisture rich environment, the floodplain shared a pattern consistent with the surrounding uplands—savanna communities predominated. Floodplain tree density estimates were only 19 and 5 trees/ha (Reaches 4 and 8, respectively). In the modern upland landscapes, the former savannas have been replaced by agricultural fields with forested patches. This type of habitat conversion and fragmentation has been especially severe in the uplands surrounding Reach 4. The modern floodplain landscapes show varying degrees of change from their presettlement conditions. River Reach 4 still retains a large percentage of its presettlement forest area despite river impoundment, but Reach 8 has suffered a 6,000 hectare loss (~68% reduction). The remaining floodplain prairies and marshes are much smaller than their presettlement counterparts, while others have been replaced by forest. Flood disturbance has long been recognized as an important factor influencing plant succession on floodplains, while fire is recognized as the primary disturbance mechanism on the uplands. However, it is likely that both fire and flood shaped the presettlement floodplain vegetation patterns as indicated by the distribution of former prairies and savannas. Prescribed burning could be used to safely reintroduce fire to the river-floodplain ecosystem and surrounding uplands, while navigation dam operating procedures might be modified to more closely mimic natural flood patterns.

Bartels, A. D. 1997. Fisheries data and the Long Term Resource Monitoring Program: Data collection. Platform presented at 59th Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin, December 7-10, 1997.

The fisheries component of the Long Term Resource Monitoring Program (LTRMP) was initiated in 1989 to detect trends in Upper Mississippi River System fish communities and populations and to provide ecological information to river managers in the form of data, reports, and maps. Standardized fish sampling is conducted in Navigation Pools 4, 8, 13, 26, and in the open river reach (just upstream of the confluence of the Ohio River) of the Upper Mississippi River. Sampling is also conducted in the La Grange Pool of the Illinois River. Fish are collected using multiple gear types. Fish sampling is spatially allocated by gear type, using a stratified, random study design. Sampling strata are defined based on geomorphic regions that have been mapped and entered into a Geographical Information System (GIS). These strata are only updated when large-scale, enduring changes occur to the river's geomorphology. Using a GIS, sampling sites are randomly selected within each stratum from a grid of points spaced 50 m apart. Field crews use Universal Transverse Mercator coordinates to construct sampling maps by plotting the coordinates on either bathymetric or land cover backgrounds. In the field, sites are either located by comparing noteworthy features of the basemap to recognizable landmarks, or by using a Global Positioning System receiver. Yearly, field crews sample during three periods between June 15 and October 31, repeating the established gear allocations for each period. The fish sampling framework is designed to produce valid estimates of relative abundance and species richness at the annual and pool-wide level of resolution.

Blodgett, K. D., R. E. Sparks, S. D. Whitney, and R. Williamson. Mussel resources of the Illinois River System—Value to Illinois' economy and natural heritage. Paper presented at the Fourth Biennial Governors Conference on Management of the Illinois River, Peoria, Illinois, October 7-9, 1997.

Despite negative impacts from pollution, major habitat alterations, and several bouts of over harvesting, native freshwater mussels persist as important components of the ecology and economies of the Illinois River and other large floodplain river ecosystems in the Midwest. However, the future of this group is uncertain, and the development and implementation of more effective management strategies to protect and even enhance these organisms is critical to their continued existence.

Mussels can be important constituents of the ecology of large rivers; these filter feeders remove organic matter from the water column, converting it into usable biomass for higher-level consumers such as fish and muskrats. They provide stable substrates in habitats of shifting sands or soft flocculent sediments and are sites of attachment for aquatic invertebrate eggs and aquatic insect larvae. Mussel beds are used by many fish for nursery and feeding areas. Mussels' sedentary habits and sensitivity to poor water quality make them good biomonitors, their presence indicating relatively good water quality, and their disappearance or absence alerting us to potential problems.

The historical importance of mussels to humans is well documented at archaeological sites throughout the Illinois River Valley. Native Americans used mussels for food and their shells for tools and ornaments. Early settlers harvested mussels for the infrequent but highly prized pearls they yielded. Beginning about 1891, mussels were used as the raw material for the pearl

button industry, which became a multi-million-dollar industry in the United States by 1899. With the advent of plastics, the pearl button industry died out by the late fifties, but in the sixties, the development of techniques for culturing pearls provided a new market for mussel shells. Today their shells are harvested from Midwestern rivers and exported to Japan, the current center of the cultured pearl industry. Reports submitted to the Illinois Department of Natural Resources indicate that in Illinois, annual sales of shells harvested from the Illinois and Mississippi Rivers averaged about 970 tons per year from 1963 through 1995, with the maximum reported harvest of 1963 tons in 1985. In 1995, shellers received an average of \$1.59/lb for these shells.

Today, freshwater mussels are one of the most endangered groups of organisms. Of 297 taxa described for North America, 213 (72%) are considered extinct, endangered, threatened, or of special concern. Management of our mussel resources is impeded by our incomplete knowledge about these complex organisms. They have a complicated life cycle which necessitates a fish host for completion of its larval stage. Field studies to better understand the life history and ecology of mussels often are confounded by impacts of navigation, habitat alterations, pollution, and harvest. Such investigations often require the use of diving that is laborious, expensive, and can be dangerous. Today, the preservation and enhancement of our mussel resources, the services they perform, and their economic values are dependent upon the development and implementation of sound, science-based management strategies. Without increased efforts to understand and protect these organisms, their future is questionable.

Fischer, J. R., D. M. Soballe, and J. T. Rogala. 1997. Factors affecting fish habitat during periods of ice cover on the Upper Mississippi River. Poster

presented at 59th Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin, December 7-10, 1997.

The Upper Mississippi River System (UMRS) is highly complex in both morphometry and hydrodynamics, resulting in a mosaic of habitats for fishes. Overwintering conditions for centrarchid fishes in backwaters of the UMRS are a primary concern to river managers, but relatively few data have been collected to describe winter conditions. Factors affecting under-ice conditions vary with time and location and are often difficult to isolate. Winter limnological data have been collected on several study reaches of the UMRS for the Long Term Resource Monitoring Program since 1994. Results of stratified random sampling show that winter conditions are highly variable and that ideal habitat conditions are rare, with temperature, depth, dissolved oxygen, and velocity all limiting the amount of suitable overwintering habitat. During the winters of 1996 and 1997, spatially and temporally intense sampling documented the effects of minor water level fluctuations on dissolved oxygen and temperature. Results of these studies indicate that overwintering conditions vary not only by year and location, but sometimes by days or hours. Although local habitat enhancement and restoration projects are appropriate in some areas, water level management practices may also provide benefits on a larger scale.

Hansen, D. E., L. E. Leake, and A. D. Bartels. 1997. Fisheries data and the Long Term Resource Monitoring Program: Data management. Platform presented at 59th Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin, December 7-10, 1997.

Fisheries component data are collected and transcribed to data collections sheets at six Long Term Resource Monitoring Program (LTRMP) field stations on the Upper Mississippi River. Data collection sheets are then

mailed to a data entry contractor, where data is entered within five working days of receiving the data. The data contractor mails data sheets and floppy disks containing ASCII text delimited files back to LTRMP. Each disk contains two files: one for the header records (fish collection sheet) and one for the detail records (fish measurement sheet). Data is first loaded into temporary tables (through the use of control files) to ensure that it contains no data entry or field station typographical errors; it is then loaded into the permanent tables. After data is checked for duplicate barcodes in the header record table, QA/QC is run using SAS scripts. The output from the SAS scripts produces two ASCII text delimited files for input into a PC database application. One file contains the header (fish collection sheet) records and the other contains the detail (fish measurement sheet) records. These two output files are then e-mailed to the field station, where the fisheries component specialist loads the data into a PC-based data verification application. Field station fisheries specialists review the data and correct any errors they detect. For any data errors detected during the review process, two output files are generated from the PC application and e-mailed to LTRMP. The two files are processed at LTRMP by updating the permanent tables. Changes made to the PC application and the LTRMP permanent tables are synchronized at all times.

Janvrin, J., and H. A. Langrehr. 1997. Aquatic vegetation response to islands constructed in the Mississippi River. Platform presented at 59th Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin, December 7-10, 1997.

Several islands have been constructed in the Mississippi River as part of the Upper Mississippi River System Environmental Management Program. One element of this program is the construction of Habitat Rehabilitation and Enhancement Projects. Objectives for the island projects often focus on

providing improved environmental conditions to promote the growth of aquatic vegetation. Islands improve environmental conditions for aquatic plants by reducing wave resuspension of fine materials thereby improving light penetration in localized areas. Other objectives for island projects may include providing predator-free waterfowl and turtle nesting habitat, concentrate the flow of water to promote scouring of surrounding area, and disposal sites for material dredged from backwaters. Island design, construction techniques, and results of wildlife and vegetation monitoring will be presented.

Olsen, D. A., and A. D. Bartels. 1997. Fisheries data and the Long Term Resource Monitoring Program: Data products. Platform presented at 59th Midwest Fish and Wildlife Conference, Milwaukee, Wisconsin, December 7-10, 1997.

Fisheries component data from the Long Term Resource Monitoring Program (LTRMP) of the Upper Mississippi River System are accessible through several different mechanisms, each tailored to different end-user needs. The most basic product is the annual summary report, consisting of hydrographs, collection summaries, total fish counts, C/f tables, and length distributions of selected species. Also, through a form-based world wide web front end, users can submit queries to the database management system. Records meeting query criteria can be downloaded as an ASCII file suitable for use with a statistical analysis programs such as SAS. For users with the ArcView Geographic Information System software, an application is available which allows scientists and river managers to view and analyze fisheries data in conjunction with other spatial data. One of the important features of this tool is the ability to define an area spatially, then extract fisheries data for that area only. Work is in progress to bring the functionality of the ArcView application to users

through a web-based front end. This would allow users without access to ArcView the opportunity to use the LTRMP fisheries data in conjunction with the many spatial data sets available from the Environmental Management Technical Center.

Soballe, D. M., J. T. Rogala, and J. R. Fischer. 1997. Finding suitable winter habitat for fish in shallow impoundments of the Upper Mississippi River. Paper presented at the 17th International Symposium of the North American Lake Management Society, Houston, Texas, December 2-6, 1997.

A series of 28 navigation dams on the braided Mississippi River above St. Louis, Missouri, has created a string of shallow, rapidly flushed impoundments with complex morphometry and hydrodynamics. Previous studies indicated that conditions during ice cover may limit some fish populations in this system. Consequently, major restoration and habitat enhancement projects have targeted winter habitat.

The River's expanse and complexity has prevented systematic mapping or quantitative estimates of winter habitat conditions. Resource managers have acted on restoration and enhancement projects with a paucity of supporting scientific information. This study reports the results of limnological surveys conducted during four winters (1993-96) in Pools 4, 8, 13, and 26 of the Upper Mississippi River. These surveys used a randomized approach and show that suitable conditions for overwintering fish in the upper River are indeed rare, depend on weather conditions, and vary considerably among pools. Focused studies have shown that the patches of suitable habitat are often small and dynamic, changing rapidly in response to minor water level fluctuations. Overwintering fish in this system face serious challenges and may be highly vulnerable to habitat loss. The results of these studies are allowing us to predict the location and extent of overwintering

habitat and are helping us determine what can be done to effectively preserve or enhance it.

Whitney, S. D., D. Blodgett, and R. E. Sparks. 1997. A survey of the Unionid mussels of the Illinois River, 1993-95. Poster presented at the Fourth Biennial Governors Conference on Management of the Illinois River, Peoria, Illinois, October 7-9, 1997.

The last comprehensive mussel survey of the Illinois River, conducted in 1966-69, indicated 25 of the 49 species once found in the river had been extirpated; extensive stretches of the upper river, once densely populated with mussels, did not yield a single living specimen. What was once the most productive mussel resource per river mile in the United States, had been severely degraded by habitat loss, exploitation, and pollution. In the past three decades, mussel populations in the Illinois River have been subject to two major changes: (1) renewed commercial exploitation for the Japanese cultured pearl industry; and (2) dramatic invasion of two non-indigenous bivalves, the Asiatic clam (*Corbicula fluminea*) and the zebra mussel (*Dreissena polymorpha*). During our 1993-95 survey of the Illinois River, we assessed the impacts of these changes and determined the current status of mussel populations throughout the river.

Winkelman, J. 1997. The status of native aquatic vegetation and Eurasian watermilfoil (*Myriophyllum spicatum* L.) in select navigation pools of the Upper Mississippi River. Poster presentation at the 17th International North American Lake Management Society Conference, Houston, Texas, December 3, 1997.

Little is known about submersed aquatic plants and the status of exotic species, namely Eurasian watermilfoil (*Myriophyllum spicatum* L.), in the

Upper Mississippi River (UMR). What historical information does exist is scattered and shows that widespread changes in abundance and species composition have occurred, including the establishment of Eurasian watermilfoil. Monitoring over the last 7 years by the Long Term Resource Monitoring Program in target pools of the UMR and anecdotal information from other pools indicate widespread fluctuations and declines in some species.

In order to understand factors currently limiting the encroachment of Eurasian watermilfoil in the UMR and its potential to expand, we conducted vegetation surveys in Pools 2, 3, 4, 5, 5A, and 6 in 1996. Our investigation attempted to (1) develop extensive taxa lists for each pool and locate areas with abundant and/or diverse vegetation, (2) identify relationships between Eurasian watermilfoil and water depth, flow, and substrate, and (3) examine native species' association with Eurasian watermilfoil. Habitat types were stratified by geomorphology and select backwaters ($n = 16$) were sampled in a stratified random blocks design. Plants were sampled along transects using a double-headed garden rake to collect wet weights and rake densities of Eurasian watermilfoil and other plants.

Correlations, frequencies, taxa richness, and community and floral similarity were compared and analyzed. Floristic composition varied among pools with the greatest numbers of species found downstream of Lake Pepin, a natural riverine lake. Eurasian watermilfoil was found most often in large contiguous and flowing backwaters where it was a dominant species. Eurasian watermilfoil tended to occur with other plants, but was sparse in nearshore areas (<40 cm) where most native species grew. Eurasian watermilfoil grew deeper than most species, and when it occurred, appeared to augment the occurrence of other species. □

New Reports

The following reports were recently completed and have been distributed to Program partners. LTRMP reports are available through the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (800/ 553-6847 or 703/487-4650).

Conaway, L. K., and R. A. Hrabik. 1997. **The Ohio shrimp, *Macrobrachium ohione*, in the Upper Mississippi River.** Transactions of the Missouri Academy of Science 21:44-46. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, March 1998. LTRMP 98-R006. 3pp.

DeHaan, H. C. 1998. **Large river sediment transport and deposition: An annotated bibliography.** U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, April 1998. LTRMP 98-T002. 85 pp.

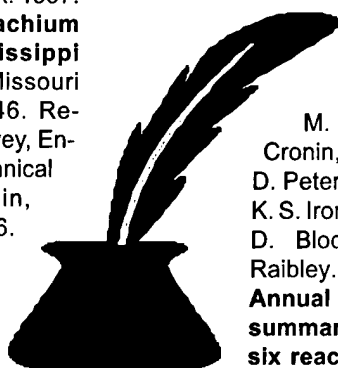
Olsen, D. A. 1998. **Spatial Query Tool for Long Term Resource Monitoring Program component data: Auser's guide.** U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, March 1998. LTRMP 98-P003. 7 pp. + Appendix + CD-ROM.

Sauer, J. 1998. **Annual status report, 1997: Macroinvertebrate sampling.** U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, March 1998. LTRMP 98-P004. 17pp.

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Continued on page 7

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